CSE5500 Algorithms

Homework 3, Due on December 5, 2018

1. Present a CRCW PRAM algorithm for finding the maximum of n given numbers in $O(1)$ time using $n^{1+\epsilon}$ processors, where ϵ is any constant > 0.

2. Input is a sequence of n numbers (not necessarily in sorted order). The problem is to compute the right neighbor of each element in the sorted order. For example if the input is $6, 12, 5, 3, 17, 11$, the output will be $11, 17, 6, 5, \infty, 12$. Present a Las Vegas algorithm for this problem that runs in $\widetilde{O}(1)$ time. You can use up to n^2 CRCW PRAM processors. (*Hint:* Assume that we can find the minimum of n elements in $\widetilde{O}(1)$ time using n CRCW PRAM processors).

3. The array A is an array of n keys, where each key is an integer in the range $[1, n]$. The problem is to decide whether there are any repeated elements in A. Show how you do this in $O(1)$ time on an n-processor CRCW PRAM. Which version of the CRCW PRAM are you using?

4. Let π_2 be a problem for which there exists a deterministic algorithm that runs in time $2^{\sqrt{n}}$ (where n is the input size). Prove or disprove:

   If π_1 is another problem such that π_1 is polynomially reducible to π_2, then π_1 can be solved in deterministic $O(2^{\sqrt{n}})$ time on any input of size n.

5. Assume that there is a polynomial time algorithm CLQ to solve the CLIQUE decision problem. Show how to use CLQ to determine the maximum clique size of a given graph in polynomial time.